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SOME FEATURES OF THE LABOR SYSTEM AND MANAGEMENT AT THE BALDWIN LOCOMOTIVE WORKS

The secret of the success of the American manufacturer, that which enables him to turn out a uniformly good article in a short time and at a low cost, lies in the energy of his production. The chief element in this production is the personnel, the character and method of treatment of the labor employed. The American manufacturer has realized the fact that to get the best result and the largest output from his plant the interest of his laborer and himself must be in harmony. This is not a sentimental theory but sound business policy. It is to the advantage of the employer to pay high wages for good work quickly and accurately done, rather than to pay low wages for slow and slovenly work. The laborer does better when he realizes that his work is appreciated and that increased effort and diligence meet with substantial recognition and reward. The workman is encouraged to exercise his brain and is given extra pay or promoted for having done something or discovered something to the advantage of his employer.

Philadelphia's prominence as a manufacturing city affords a labor market unsurpassed in quality and quantity anywhere in the United States. The large permanent population of skilled mechanics employed in the iron and steel industries of Philadelphia gives an abundant force from which to draw. These men are mostly Americans and of a high grade of intelligence.

Some features which may be of interest in the method of management of labor at the Baldwin Locomotive Works will be treated in this paper.

When locomotives first came into use they were comparatively simple in design and construction. They were built to haul a light load on a level track or on easy grades. As the number of railroads increased and the conditions of service became more severe and diversified, the types of locomotives began to multiply and the process of manufacture became more and more complex. A system of classifying the locomotives constructed was, therefore, adopted. It has been in operation for about fifty years and forms the basis of

the shop practice. The system originally involved the classification of the locomotive by the number of driving wheels and the weight of the engine. As the types multiplied still more, however, it was found that this method did not differentiate the classes sufficiently and it was subsequently modified. It is now based on the number and arrangement of the driving and truck wheels, and the size and number of the cylinders. Space will not permit a detailed description of method. The principle resembles that used in botanical scientific nomenclature, the locomotives are reduced to their genus and species by means of a combination of figures and letters which indicates the total number of wheels under the engine, the number of driving wheels, the diameter of the cylinders and whether they are single expansion or compound.

In a locomotive of new design every detail must be proved suitable in the drawing room before the work is sent to the shop. Every class of locomotives has different modifications within the class. These modifications may take the form of an increase in the diameter of the boiler, increase in length of piston stroke, and so on. Every such modification is given a drawing number. All the drawings are filed and a careful record kept of them. In this manner the work of the drawing-room is simplified and new drawings can be produced with the utmost facility.

By this method, also, the work in the shop is simplified. All locomotives of a class and drawing being uniform throughout in their fundamental features, a system of gauges and templates is in use by which such parts of locomotives and such fits of connections as may be desired are made absolutely interchangeable.

The capacity of the establishment is thirty-six locomotives a week. Orders are allotted spaces in the week in which delivery is promised. If a new design has to be made, the drawing must be completed and data submitted to the purchasing department for ordering material before the work is ordered in the shop. All parts of locomotives and tenders, except boiler and tank plates, steel tires and steel castings, chilled wheels, boiler tubes and special patented appliances are made from the raw materials. All parts ordered by the purchasing department are ordered for a definite locomotive or a number of locomotives of a particular class and must be invoiced as such.

The foremen of the different shops where the various com-

ponent parts of the locomotive are made are furnished a list, bearing the class designation of the locomotives for which the parts made in his shop are intended. When the drawings are furnished him he allots the work and sees to it that it is finished by the time specified on the list. Each part is marked with the class designation of the locomotive for which it is intended. Each workman reports to the time-keeper through his boss or through the foreman his time for each piece and the locomotive for which the piece was intended. All these component parts are assembled in the erecting shop at the appointed time and, by means of this unit system, the finished locomotive is put together without confusion or unnecessary delay.

A further advantage of this unit system of production appears in the accounting department. Two sets of books are kept—a financial and a manufacturing set. In the financial department accounts are kept of sales, purchases and expenditures. In the manufacturing books a separate account is opened with each locomotive and the material entering into its construction and the labor expended on it are charged against that locomotive. At the end of the year these two sets of books must balance each other. By this method the actual cost of each locomotive is obtained with accuracy and, allowing for fluctuations in price of raw materials, correct quotations can be made for any class of engine.

It is upon this unit system of locomotive classification, by means of which the identity of each locomotive is preserved, that the system of the labor organization and management of the establishment is based. Having mentioned the chief points in the method of manufacture let us glance at the personnel of the men.

About thirteen thousand men are on the pay-roll of the Baldwin Locomotive Works at the present time. The majority of these are Americans, although representatives of nearly every nationality on the face of the globe are found among them. The only requirements of an employee are a good record, a fair amount of intelligence and a willingness and ability to do the work. About 10 per cent of the total number employed are boys under the age of twenty-one years. A large proportion of these are apprentices being taught a trade. Strict conformity is observed with regard to the state factory regulation prohibiting the employment of boys under sixteen years old. Boys under sixteen are taken on only in extreme cases of pov-

erty or distress and then only if they hold a magistrate's certificate, as required.

A great variety of skilled labor is employed, some of the different kinds are iron-founders, brass-founders, blacksmiths, machinists of all kinds, wood-workers, tinnerns, carpenters, painters, copper-workers, plasterers and sheet-iron-workers. A skilled laborer is here understood to mean one who is familiar with the use of a tool, a machine or a process; an unskilled workman is one who cannot run a tool but does ordinary laboring work. The number of skilled and unskilled workmen is divided in the ratio of about two-thirds skilled to one-third unskilled.

Wages are reckoned by the hour and not by the day. Unskilled laborers have a per-hour rating. Piece-work wages, for convenience in accounting, are equated to a per hour rate. A piece-worker can earn the equivalent of from 18 to 50 cents an hour according to the character of the work and the ability of the man. The average wage of skilled labor is 30 cents per hour. The average wage of unskilled labor is about 16 cents per hour. The men are paid on Friday for their time in the preceding week. Each man has a number which is assigned to him on entering the employ of the Baldwin Locomotive Works. Each shop has a given block of numbers for its quota of men. When the whistle blows to stop work at six o'clock on Friday the men in the different shops file by certain booths, each giving his number and receiving his pay envelope which contains in coin the amount due him and on which is written the name, number and amount. Payment is made in coin to insure accuracy and a saving of time in making up the amounts.

The shops are run continuously twenty-three hours a day and the force is divided into day and night shifts. The day shift is on at seven and off at six with an hour from twelve to one for lunch; the night shift goes on at six and off at seven in the morning, having twenty minutes for lunch at midnight, which is not deducted from their time. A monitor whistle blows at three minutes before the hour at seven and one; at the hour each workman is required to be at his place and commence work when the signal is given. When late, a workman must secure a "late pass" at the office, which must be presented to the watchman at the gate before he is allowed to report for work. A time-worker is fined for being unpunctual, an hour's time for the first hour or fraction thereof he is late. Except in rare cases

men are not allowed to report after 8 a. m. Piece-workers are fined one hour's rate no matter how late they are. Workmen quitting or preparing to quit before the stop signal is given are fined one hour's time. As time is money when so many men are employed the rules regulating attendance are strictly enforced. The moral effect of the "late pass" on the foreman's desk is quite an aid to punctuality.

Each workman must know before commencing a piece of work, that it will finish to the sizes marked on the sketch or card given him and whether the work is to be completed by himself or others. A rigid system of inspection is enforced in the shops to insure the work being done properly and accurately. Damage for spoiled work is charged to the workman, unless occurring from a reasonable cause, and must be reported at once to the foreman. A workman accepting a piece of work from another to finish is held responsible for any errors in the work of his predecessor. Work must be kept neatly filed and properly marked with the class designation and number of the locomotive for which the piece is destined, and each succeeding workman must see that the mark is continued on work finished by him. All work, as soon as completed at one machine, must be delivered to the next succeeding machine. Economy in the use of material of all kinds, oil, waste, emery, files, etc., is strictly enjoined on every workman.

Each employee is responsible for the tools placed in his charge on commencing work, and upon leaving the employ of the establishment he must deliver the key of his box or drawer to the foreman and satisfy him that the stock of tools is complete and in proper order. Each workman is required to keep his bench, vise, lathe, forge, machine, or whatever tool or place at which he is employed, cleaned and free from rubbish. Careless damage to a tool is charged to the workman.

A workman whose machine breaks down through no fault of his own, or while waiting for work, receives a per hour rate proportionate to his piece-rate, at the discretion of the foreman. A workman running two or more machines on piece-work, however, is not paid an hour rate for time lost by one machine on account of a break down, or while waiting for work.

Workmen are required to report to the timekeepers as follows: Number of hours per day; name of machine; designation of engine

or job for which the part is made; when commenced and when finished. Piece-workmen are required to return and charge all their completed work in the week in which it is finished. They do not receive pay for their work unless they comply with this regulation. Piece-workers personally see that timekeepers get their correct time daily, they also must enter on their slates, each evening before leaving the works, their time for the day.

Having glanced at the personnel of the workmen we will discuss some phases of the system which present themselves. The unit system of production makes it desirable that all work should be turned out by the piece. In the Baldwin Locomotive Works two forms of piece work are represented, viz: Piece-work proper, where the workman is paid according to the quantity produced; and a contract system, where sub-foremen, called contractors, are entrusted with the execution of a portion of the work on a locomotive; for example, the entire construction of the cylinders, or the erection of a certain number of tanks. The contractor has entire charge of the job, seeing that the raw material is delivered in time, that the men are prompt and diligent, that tools are in repair and machines do not break down. The contractor is paid for the job, the firm paying directly to each workman for the labor on the job. The contractor cannot, therefore, get more than the amount due him on any one job by curtailing the wages of his labor. The contractor is a piece-worker on a larger scale. As he is paid by the job, he has an incentive to turn out his work as quickly as possible and to get as much work as possible out of the men under him.

The following occurrence illustrates the value of the contract system in expediting work. Tanks are built exclusively in one of the shops comprised in the Works. The frames and bodies are built on the second and third floors and are taken in an elevator to the fourth floor, where they are erected over the trucks. The elevator broke down one day and the job was held up. The contractor was losing money as he could not turn out his tanks. The elevator was running inside of two days; in the ordinary course of events two weeks would probably have been taken to put it in working order.

The contract and piece-work systems insure quantity of product; a rigid system of inspection insures quality of product. In order to insure good workmanship an extremely rigid system of inspection is maintained and contractors and piece-workers are held

to strict account if the quality of their work falls below the standard. Another feature of the piece-work system, which is at the same time an advantage and a disadvantage, is the specialization which it naturally entails. In the kind of machine work done at the Baldwin Locomotive Works, the same operation is performed over and over again many times. The piece-worker, doing the same thing repeatedly, soon finds out the best and quickest way to do the work and, as he can make more money doing his specialty, he is naturally unwilling to be shifted to another machine or another class of work. The tendency of this specialization is to limit the workman to a single process, and, as a result, the general mechanic has threatened to become practically extinct, to the detriment of manufacturing interests generally.

To remedy this disadvantage an apprenticeship system was inaugurated at the Baldwin Locomotive Works in March, 1901. The apprentices taken on are divided into three classes, as follows:

First class apprentices comprise boys who have had a good common school education and are not over seventeen years and three months of age. They are indentured for four years. An apprentice of this class is required to attend at least two evenings in each week during the first three years of his apprenticeship, free night schools, such as during the first year will teach him elementary algebra and Geometry, and during the remaining two years shall teach him the rudiments of mechanical drawing.

Applications for indenture as second class apprentices are considered from boys who have had an advanced grammar or high school training, and are not over eighteen years of age. The term for this class is three years. The apprentice is required to attend night schools, which shall teach him the rudiments of mechanical drawing, for the first two years of his indenture.

The third class indenture is in the form of an agreement made with persons twenty-one years of age or over, who are graduates of colleges, technical schools, or scientific institutions, having taken courses covering the higher mathematics and the natural sciences, and who desire to secure instruction in practical shop work.

The indentures or agreement in each case place upon the firm the obligation to teach the apprentice his art thoroughly and to furnish him abundant opportunity to acquire a practical knowledge of mechanical business. The firm is also bound to retain the apprentice

in service until he has completed the term provided for in the indenture or agreement, provided his services and conduct are satisfactory. In all cases the firm reserves the right to dismiss the apprentice for cause.

The rates of pay in the different classes are as follows :

	1st year per hour.	2d year per hour.	3d year per hour.	4th year per hour.
Apprentices of the First Class	5c.	7c.	9c.	11c.
Apprentices of the Second Class	7c.	9c.	11c.	
Apprentices of the Third Class	1st 6 mos. of 1st year, 13c. per hr. 2d 6 mos. of 1st year, 16c. per hr. 1st 6 mos. of 2d year, 18c. per hr. 2d 6 mos. of 2d year, 20c. per hr.			

In addition to the rates mentioned above, apprentices of the first class each receive an additional sum of \$125.00, and apprentices of the second class an additional sum of \$100.00, at the expiration of their full terms of apprenticeship respectively.

The apprentices are under the direct supervision of a superintendent, and a careful record is kept of the performance of each. The apprentices are put to work in the shop on the different machines, millers, slotters, planers, lathes, boring machines, etc. They are shifted to a different machine every three months and an account of their work entered in the superintendent's book. Apprentices of the third class are shifted as often as they wish from one machine to another. On the completion of his indenture, if he wishes it, and his record has been satisfactory, the apprentice can secure a good position at the works, at the start generally as track boss, inspector, or in some such capacity. There are about three hundred apprentices on the books at the present time, about two hundred of them are in the first, about sixty in the second and about forty in the third class. The object is to turn out good, all-around machinists and good results are hoped for from the system.

The policy of the firm is to make the interest of the men identical with its own. Hard work is required but high wages are paid, ingenuity is encouraged, and intelligent and faithful work is liberally rewarded. Piece-rates are seldom cut, and then only on account of the introduction of a time-saving tool in which case the workman shares in the gain accruing. The policy is to maintain a uniform piece-rate for all the men doing a certain class of work. If one man

shows especially marked ability, he may be shifted to another job; usually being made a contractor or sub-foreman. The policy of the establishment is to make promotions from within, foremen, bosses or superintendents are not imported. There are no hereditary rights to important positions.

Strikes are practically unknown. If a man has any grievance he can submit it to the superintendent and he knows that his complaint will receive careful consideration and that he will be dealt with fairly. No one is questioned, when he enters the employ, whether he is affiliated with a trades union or not, but trades-unionism does not flourish at the works.

A pleasing and noteworthy feature of the attitude of the men is the *esprit de corps* which prevails. They realize that their employers are doing their best for them and only ask in return the best work of each man. Every man is proud of the establishment he works for, the oldest of its kind in the country, and every man is proud to be known as a Baldwin man.

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